BAYOU QUEUE DE TORTUE WATERSHED TMDL

FOR TOTAL DISSOLVED SOLIDS (TDS)

Subsegment 050501

US EPA Region 6

Final

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standard and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be allocated to point sources and nonpoint sources discharging to the waterbody.

The Bayou Queue de Tortue watershed is subsegment 050501 of the Mermentau River Basin. Subsegment 050501 is comprised of Bayou Queue de Tortue and all tributaries, including Indian Bayou, Prime Gully, Coulee des Iles/Grand Marais Bayou, Lyon's Point Gully, Lazy Point Canal and numerous unnamed tributaries. Bayou Queue de Tortue was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not meeting the water quality standard for total dissolved solids (TDS). Bayou Queue de Tortue was ranked as high priority (priority 1) on both lists for development of a Total Maximum Daily Load (TMDL).

Bayou Queue de Tortue has been heavily hydromodified in all reaches except the upper (above LA Hwy. 35) and lower (below LA Hwy. 91) reaches. The bayou and its tributaries are dominated by rice and soybean propagation. Both of these conditions have inhibited the bayous natural processes, including reaeration and fish propagation (Smythe and Malone, 1989a-a, 1990). TDS has been cited as a contributing factor in the bayou's inability to meet designated uses. TDS samples over the period of record for the ambient water quality monitoring station located on Bayou Queue de Tortue exceeded the 260 mg/l TDS water quality standards 62.4% of the time. An exceedance rate of less than 30% is required to be fully supporting for TDS.

This TMDL calls for all sources of TDS to the bayou to meet the 260 mg/l TDS water quality standard. This water quality standard for TDS is to be applied equally to point and nonpoint sources. The TDS TMDL was developed based on simple dilution calculations using average flow and the state TDS criterion of 260 mg/l for this subsegment. The TMDL calculation includes wasteload allocations, load allocations, and a margin of safety. A 27.4% reduction in TDS loading will be needed to meet the standard for the propagation of fish and wildlife.

1. Introduction

The Bayou Queue de Tortue sub-segment impacts from rice cultivation activities have been studied extensively by LDEQ and through nonpoint source studies conducted by the University of Southwestern Louisiana. Smythe and Malone (1990) concluded that the use impairment of streams in the Mermentau Basin may be due to the cumulative influences of agricultural nonpoint source discharges and channelization. Water quality data generated from the monitoring program on Bayou Queue de Tortue verified that "the water quality in all categories of use (fishing, recreation and irrigation) is impaired due to high TDS" along with other causes (Smythe and Malone, 1990).

2. Basin Description

2.1 Mermentau River Basin

Berger (2000) describes the Mermentau River Basin as follows:

"The Mermentau River Basin is located in southwestern Louisiana, and it encompasses the prairie region of the state and a section of the coastal zone. The Mermentau River Basin is bounded on the north and east by the Vermilion-Teche River Basin, on the west by the Calcasieu River Basin, and on the south by the Gulf of Mexico. The Mermentau River Basin is approximately 3,710 square miles in area, excluding the gulf waters segment (LDEQ, 1996).

The slope of the land toward the Gulf is very gradual, and as a result, the streams in the Mermentau Basin are characteristically sluggish. Fish kills have been commonly reported throughout the basin. Because waterbodies in the basin have little gradient and sluggish flows, their reaeration potential is low (LDEQ, 1990). Prior studies have shown that the water quality problems in the basin are largely due to agricultural runoff and hydrologic modification (Smythe and Malone, 1990)."

2.2 Bayou Queue de Tortue Watershed, Subsegment 050501

Berger (2000) describes the Bayou Queue de Tortue watershed as follows:

"This area is typical of the basin with its low relief, which is an ideal condition for agricultural use as documented in Table 1 (LA DEQ, 1999[b]). Segment 0505 is comprised of Bayou Queue de Tortue as the main stem with several tributaries. These tributaries include Indian Bayou, Prime Gully, Coulee des Iles/Bayou Grand Marais, Lyon's Point Gully, Lazy Point Canal, and many unnamed tributaries.

Average annual precipitation in the segment, based on the nearest Louisiana Climatic Station in Crowley is 56.91 inches based on a 30-year record (LSU, 1999). Land use in the Mermentau River Basin is largely agricultural. Rice and soybean farming operations are the predominant land use types in the Bayou Queue de Tortue watershed. Originally, this area was covered by tall prairie grasses, among which there were scattered clumps of trees. (Soil Survey, 1962). In the segment under study, agricultural uses account for 86.5 percent of the total segment area. Land uses in Segment 0505 are shown in Table 1 (LA DEQ, 1999[b])."

Table 1. Land uses in Segment 0505 of the Mermentau River Basin (Berger, 2000)

Land use	Acres	%
Urban	7,051.0	3.6
Rangeland	490.0	0.3
Agricultural	168,853.0	86.5
Forest Land	2,820.0	1.4
WATER	4,110.0	2.1
Wetland	11,849.0	6.1
Barren Land	47.0	0.0

Bayou Queue de Tortue has been heavily hydromodified in all reaches except the upper (above LA Hwy. 35) and lower (below LA Hwy. 91) reaches. Berger (2000) continues: "In order to irrigate the rice fields, Bayou Queue de Tortue is periodically dredged. Dredging of the bayou has occurred for many years. It has altered the route and flow of the bayou." Dredging has probably reduced the bayou's abilities to perform natural processes, such as sediment transport and fish propagation (Smythe and Malone, 1989a-f, 1990).

Bayou Queue de Tortue changes significantly from its headwaters to its lower segments. According to a 1992 LDEQ report,

> "the upper headwater areas above have not been hydromodified as much as lower segments. Between rivermile 22.5 and 30.7 the bayou is highly channelized, sluggish, and extremely turbid. The stream bank is extremely unstable and erosion is severe with numerous tree roots exposed and trees falling into the bayou. Between rivermile 30.7 and 16.6 the bayou is a natural unchannelized swampy area with numerous sinuosities. Dominant tree species include bald cypress, tupelo gum and other southern swamp species. Aquatic macrophytes and floating aquatic vegetation is abundant."

2.3 Water Quality Standards

The State of Louisiana has developed Water Quality Standards for waters of the state (LDEQ, 1999[a]). The standards are defined according to designated uses of the waterbodies. Designated uses for Bayou Queue de Tortue from its headwaters to the Mermentau River (waterbody subsegment 050501) include primary contact recreation, secondary contact recreation, propagation of fish and wildlife, and agriculture.

TDS is addressed in the Louisiana Water Quality Standards at LAC 33:IX.1113.C.2. Louisiana's water quality standards for chloride, sulfate, and TDS are applied as follows:

> "Numerical criteria for these parameters generally represent the arithmetic mean of existing data from the nearest sampling location plus three standard deviations. For estuarine and coastal marine waters subsegments in Table 3 that have no listed criteria (i.e., designated N/A), criteria will be established on a case-by-case basis using field determination of ambient conditions and the designated uses. For water bodies not specifically listed in the Numerical Criteria and Designated Table, increases over background levels of chloride, sulfate, and TDS may be permitted. Such increases will be permitted at the discretion of the office on a case-by-case basis and shall not cause in-stream concentrations to exceed 250, 259, and 500

mg/l for chloride, sulfate, and TDS, respectively, except where a use attainability analysis indicates that higher levels will not affect the designated uses. In permitting such increases, the office shall consider their potential effects on resident biota and downstream water bodies in addition to the background conditions. Under no circumstances shall an allowed increase over background conditions cause any numerical criteria to be exceeded in any listed water body or any other general or numerical criteria to be exceeded in either listed or unlisted water bodies."

Waterbodies are placed on the 303(d) list based on the comparison of data from ambient monthly samples and the appropriate criteria or guidelines. Data for this purpose was collected from Bayou Queue de Tortue at water quality station 0046 north of Gueydan, Louisiana. The period of record for the station is from 1994 through 1998. Evaluations of these data show that 62.4% of all samples are greater than the 260 mg/l TDS criterion. Guidelines for assessing use support are found in the 1998 Louisiana 305 (b) report. TDS is used to evaluate the fish and wildlife propagation designated use. As such, if the TDS criterion is exceeded in 31% or more of the samples analyzed, the use is determined to be not supported and therefore requiring the development of a TMDL.

3. Development of the TMDL

3.1 Establishing the water quality target

The designated uses for Bayou Queue de Tortue include the propagation of fish and wildlife. TDS serves as the indicator for the water quality criteria and for assessment of use support. Louisiana's water quality criterion for TDS is 260 mg/l (Subsegment 050501).

3.2 Linking Water Quality and Pollutant Sources

A number of studies have been completed by LDEQ on various segments of the bayou. These studies cite runoff into the stream from ricefield cultivation as a primary contributor of TDS. The critical discharge periods for rice culture are 1) water leveling (field preparation); 2) planting and subsequent post-plant draining; and 3) pre-harvest (Smythe and Malone, 1990). The post plant draining, which usually occurs in April-May, has been documented to have the most deleterious effect on the receiving water body because these discharges are contaminated with sediment (Smythe and Malone, 1990). During April and May, large volumes of very turbid water have been observed flowing downstream in these waterbodies (streams with rice field discharges) and this has been associated with planting activities in adjacent rice fields (LDEQ, 1990a).

3.3 Current Load Evaluation

TDS loads have been calculated using the instream TDS concentration and the flow of the stream. The following equation can be used to calculate TDS loads.

Equation 1: C x Q in cfs x 5.39 lb/day or C x Q in MGD x 8.34 lb/day

Where: C = concentration in mg/l; and
Q = stream flow in cfs or MGD.

A traditional expression of the loading may be developed by setting one critical or representative flow and concentration, and calculating the TDS load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use. LDEQ has monthly monitoring data for Bayou Queue de Tortue north of Gueydan (see data at http://www.deq.state.la.us/surveillance/wqdata/0046wqng.txt). For the purpose of calculating the current TDS load in Bayou Queue de Tortue, the available data was used because it contained more than 5 years worth of data. For the purpose of calculating current loading on this waterbody, the average TDS concentration from 5 years of data was calculated. In Bayou Queue de Tortue, the monthly TDS concentrations ranged 66 mg/l to 1106 mg/l over a 5-year period (January 1994 - May, 1998). The average TDS concentration is 358 mg/l. In addition, the average flow for Bayou Queue de Tortue (305.16 mi^2) is 392 ft^3/sec (see Appendix A). Using these values and Equation 1, it is estimated that the current loading is 756,411 lb/day.

3.4 Load Reduction

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 (or Harmonic mean flow) at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. The load reduction needed to meet the water quality standard for propagation of fish and wildlife in Bayou Queue de Tortue at 392 cfs is 207,062 lb/day (27.4% reduction). This was obtained by calculating the allowable TMDL at 392 cfs for the 260 mg/l criterion (549,349 lb/day) and subtracting this load from the observed load of 756,411 lb/day.

Current Load - TMDL = Load Reduction

756,411 lb/day – 549,349 lb/day = 207,062 lb/day

3.5 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require point source discharges of treated sanitary wastewater to maintain the in-stream TDS water quality standard of 260 mg/l in this subsegment. The Bayou Queue de Tortue watershed includes approximately 30 known dischargers, according to LDEQ's permit tracking system. Most of the facilities have flows less than 50,000 gallons per day. Due to the small loads and their distances from the waterbody, it is unlikely that they are having an impact on the waterbody named on the 303(d) list. These small dischargers are accounted for as nonpoint loading in the load calculations (Berger, Jr., 2000).

3.6 Load Allocation (LA)

The load allocation for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL@ given flow and criterion) - (WLA) = LA

LA at an instream flow of 392 cfs = 549,349 lb/day

549,349 lb/day (TMDL@ 392 cfs) – 0.0 lb/day (WLA) = 549,349 lb/day

3.7 Seasonal Variability

Louisiana‘s water quality standard for TDS is for January through December. Therefore, no seasonal TMDL for TDS was developed.

3.8 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for TDS, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average flows to calculate current loading to obtain load reduction.
- Treating TDS as a conservative pollutant, that is, a pollutant that does not degrade in the environment.

4. Other Relevant Information

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for monitoring the quality of the state’s surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state’s surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state’s biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through

this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins are monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Mermentau River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

Berger, Jr., William C. 2000. "Bayou Queue de Tortue Watershed TMDL for Dissolved Oxygen and Nutrients Including a Point Source Wasteload Allocation for the City of Duson STP and a Watershed Nonpoint Source Load Allocation, Subsegment 0505, Volume 1, TMDL Report", Water Quality Modeling Section, Watershed Support Division, Office of Water Resources, Louisiana Department of Environmental Quality, 30pp.

LA DEQ Ambient Network Database (http://www.deq.state.la.us/surveillance/wqdata/0046wqng.txt)

____, 1990a. *"Nonpoint Source Assessment Report", State of Louisiana Water Quality Management Plan: Vol. 6, Part A*, LA DEQ Office of Water Resources, Baton Rouge, Louisiana.

____, 1990b. *"Water Quality Inventory", State of Louisiana Water Quality Management Plan, Volume 5, Part B.* LA DEQ Office of Water Resources, Water Quality Management Division, Baton Rouge, Louisiana.

____, 1996. *"Water Quality Inventory", State of Louisiana Water Quality Management Plan, Volume 5, Part B.* LA DEQ Office of Water Resources, Water Quality Management Division, Baton Rouge, Louisiana, p. A-32.

____, 1998. *"Water Quality Inventory"*, LA DEQ Office of Water Resources, Water Quality Management Division, Baton Rouge, Louisiana.

____, 1999a. *Environmental Regulatory Code: Part IX. "Water Quality Regulations"*. Baton Rouge, LA: LA DEQ Office of Water Resources, Water Quality Management Division. pp. 179.

____, 1999b. *"La. Gap Land Use/Land Cover: Bayou Queue de Tortue Drainage Area", Map date: October 8, 1999*. Louisiana Department of Environmental Quality, GIS Center.

Louisiana State University. 1999. State Office of Climatology.

Permit Tracking System (PTS). Louisiana Department of Environmental Quality.

Soil Survey. 1962. Acadia Parish, Louisiana, USDA, SCS, Series 1959, No. 15.

Smythe, E.D. and R.F. Malone. 1989a. *"Hydrology and Hydraulics in Bayou Queue de Tortue,"* Department of Civil Engineering, Louisiana State University, CEASL Research Group (unpublished).

Smythe, E.D. and R.F. Malone. 1989b. *"Mermentau River Basin: Bayou Queue de Tortue Preliminary Instream Water Quality"* Department of Civil Engineering, Louisiana State University, CEASL Research Group (unpublished).

Smythe, E.D. and R.F. Malone. 1989c. *"Bayou Queue de Tortue Fish Assay"* Department of Civil Engineering, Louisiana State University, CEASL Research Group (unpublished).

Smythe, E.D. and R.F. Malone. 1989d. *"Mermentau River Basin: Bayou Queue de Tortue Instream Water Quality, Continuing Monitoring Report"* Department of Civil Engineering, Louisiana State University, CEASL Research Group (unpublished).

Smythe, E.D. and R.F. Malone. 1989e. *"Mermentau River Basin: Preliminary Instream Water Quality"* Department of Civil Engineering, Louisiana State University, CEASL Research Group (unpublished).

Smythe, E.D. and R.F. Malone. 1989f. *"Mermentau River Basin: Preliminary Ricefield Studies"* Department of Civil Engineering, Louisiana State University, CEASL Research Group (unpublished).

Smythe, E.D. and R.F. Malone. 1990, *"Final Report: The Impairment of Bayou Queue de Tortue by Channelization and Nonpoint Agricultural Runoff"*, Department of Civil Engineering, Louisiana State University, CEASL Research Group.

USGS Daily Streamflow Database (http://water.usgs.gov/nwis/discharge).

APPENDIX A. Flow information

Flow for this subsegment was determined based on USGS daily mean streamflow data measured on Bayou Queue de Tortue at Riceville, Louisiana (USGS 08012300) over the period of July 1982 through September 1999. One year of data (October 1984 – September 1985) is missing from the USGS dataset and was not considered when calculating average streamflow. It should be noted that there are an additional 680 days over the period of record for which no streamflow data are available. Various data gaps exist in the dataset. Some of these gaps encompass several months. Attempts were made by EPA to estimate flow for three of the longer periods (320 days including 12/21/92 – 5/27/93, 3/17/94 – 4/18/94, and 5/30/96 – 10/3/96) for which no data were available and that, presumably, would represent high flow periods. Flow estimates were used to determine whether the overall mean of existing streamflow data points would be significantly affected by these missing data. Daily mean streamflows measured over these same periods but in different years were averaged to attain a flow estimate for each period. These daily mean streamflow estimates were then used to fill in the data gaps and in recalculating the overall average daily streamflow. It was determined that the overall average daily streamflow did not change significantly (0.6 cfs increase) using estimated flow values in the place of the 320 missing values. Therefore, it has been assumed that the average daily streamflow using only existing data (to the exclusion of flow estimates) is appropriately representative of flow conditions in this subsegment. The average daily streamflow in Bayou Queue de Tortue is estimated to be 392 cfs.

Flow data for this station (Site Number: 08012300, Site Name: BYU Queue de Tortue @ Riceville, LA) can be located on the USGS web site at:

http://water.usgs.gov/nwis/discharge